UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/550,860	07/10/2006	Michele Muccini	MOD3216P0381US	3415

32116 7590 10/11/2011

WOOD, PHILLIPS, KATZ, CLARK & MORTIMER
500 W. MADISON STREET
SUITE 3800
CHICAGO, IL 60661

EXAMINER	
SUCH, MATTHEW W	
ART UNIT	PAPER NUMBER
2891	
MAIL DATE	DELIVERY MODE
10/11/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/550,860	MUCCINI ET AL.	
	Examiner	Art Unit	
	Matthew W. Such	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 August 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-6,8-16,19-22 and 24-28* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-6,8-16,19-22 and 24-28* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 12, 15-16, 21-22 and 24-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Bao (`207) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) in view of Karl (Synth. Met., Vol. 133-134, Page 651; provided as evidence of properties).

a. Regarding claim 1, Bao teaches an electroluminescence generating device (see Figs. 23-24) comprising a channel (Element 91) of a single thin layer of a single polycrystalline small molecule layer (see Figs. 20A-20F, for example; Col. 2, Lines 29-31; Col. 6, Lines 45-67; Col. 8, Lines 22-27 and 50-62), a source electron electrode (Element 92), said electron electrode being in contact and on top of said channel said electron electrode being able to inject electrons in said channel layer, a drain hole electrode (Element 93), said hole electrode being spaced apart from said electron electrode, said hole electrode being in contact and on top of said channel and said hole electrode being able to inject holes into said channel, and a control electrode (Element

94) positioned on said first side of the channel (top) and a second side of the channel (bottom). Regarding the language of "whereby light emission of said electroluminescent generating device can be acquired by applying an electrical potential between said electron electrode and said hole electrode" the functional descriptions and manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). See MPEP § 2114. The recitation of "whereby light emission of said electroluminescent generating device can be acquired by applying an electrical potential between said electron electrode and said hole electrode" is an intended use functional language which does not differentiate the claimed device from the prior art device, which teaches the structure of the claim as described above. Additionally, Bao teaches the functionality of the generating light emission by applying an electrical potential between the electron electrode and the hole electrode (see Element 96; Col. 2, Lines 22-28; Col. 9, Lines 16-17; Col. 10, Lines 5-22). Since the oligomers of Bao emit light, they are able to carry electrons and holes, as the light emission is due to electron / hole recombination. This evidenced by Shen who teaches that light emission requires the combination of electrons and holes and that the emitting organic semiconductor carries both electrons and holes (Fig. 1 and associated text). This is also evidenced by Karl who teaches that pure organic semiconductors intrinsic, that both electrons and holes contribute to conductivity (Page 651, Right Col., Lines 32-34).

b. Regarding claim 2, Bao teaches a dielectric layer (insulating layer in Fig. 23) between the channel and the control electrode.

c. Regarding claim 3, Bao teaches that the dielectric layer is, for example, polyimide (see Col. 5, Lines 12-14).

d. Regarding claim 12, Bao teaches that the hole electrode and the electron electrode are spaced apart by, for example, 5 nm (see Col. 6, Lines 1-2).

e. Regarding claim 15, Bao teaches that the control electrode is an injection control electrode being positioned on the second side of the channel (see Fig. 23 with Element 94 on bottom). Regarding the language of "injection control electrode" and "whereby the application of an electrical potential difference between said control electrode and said hole electrode or electron electrode facilitates the injection of charge carriers into the channel" the functional descriptions and manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). See MPEP § 2114. The recitation of "injection control electrode" and "whereby the application of an electrical potential difference between said

control electrode and said hole electrode or electron electrode facilitates the injection of charge carriers into the channel" is an intended use functional language which does not differentiate the claimed device from the prior art device, which teaches the structure of the claim as described above. Additionally, Bao teaches such functionality since the control electrode is a gate electrode.

f. Regarding claim 16, Bao teaches that the control electrode is an injection control electrode being positioned on the second side of the channel (see Fig. 23 with Element 94 on bottom). Regarding the language of "current control electrode" and "whereby the application of an electrical potential difference between said control electrode and said electron and/or hole electrode allows to control the current of at least one type of charge carriers" the functional descriptions and manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). See MPEP § 2114. The recitation of "current control electrode" and "whereby the application of an electrical potential difference between said control electrode and said electron and/or hole electrode allows to control the current of at least one type of charge carriers" is an intended use functional language which does not differentiate the claimed device from the prior art device, which teaches the structure of

the claim as described above. Additionally, Bao teaches such functionality since the control electrode is a gate electrode.

g. Regarding claim 21, Bao teaches a flexible or rigid substrate (see Col. 4, Lines 22-25).

h. Regarding claims 22 and 24-27, the entirety of the language of these claims are directed towards the process of making the electroluminescence generating device of claim 1. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference. As such, the language claims 22 and 24-27 only requires the electroluminescence generating device of claim 1, which does not distinguish the invention from the prior art, which teaches the structure as claimed.

i. Regarding claim 28, Bao teaches a method for generating electroluminescence using the device of claim 1 by recombination of electrons and hole injected into the channel from the electron electrode and the hole electrode (see Element 96 along with Col. 2, Lines 22-28; Col. 9, Lines 16-17; Col. 10, Lines 5-22, for example).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao (`207) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) in view of Karl (Synth. Met., Vol. 133-134, Page 651; provided as evidence of properties) in view of Christensen (`718).

Bao teaches the device of claim 1, but does not teach that the electron electrode and hole electrode are formed of at least one different material than another of the electron electrode and hole electrode.

However, Christensen teaches an electroluminescence generating device comprising a channel (Element 15), a source/drain electron electrode (Element 13), said electron electrode being in contact with said channel said electron electrode being able to inject electrons in said

channel layer, a source/drain hole electrode (Element 14), said hole electrode being spaced apart from said electron electrode, said hole electrode being in contact with said channel and said hole electrode being able to inject holes into said channel, and a control electrode (Element 18) positioned on said first side of the channel. The electron electrode and hole electrode comprise at least one material which is not comprised in another of the electron and hole electrode (see Col. 4, Lines 31-33) with the electron electrode comprising an element of Al as Li_3Al_2 (see Col. 4, Lines 31-32) and the hole electrode comprising an element of Cr as Cr_3Si (see Col. 4, Lines 32-33). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electron and hole electrodes of Bao with the different materials taught by Christensen in order to facilitate efficient light emission from the light emitting channel due to the low and different work functions of the Li_3Al_2 and Cr_3Si materials (see Col. 4, Lines 58-60 and Col. 5, Lines 26-31).

5. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bao (`207) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) in view of Karl (Synth. Met., Vol. 133-134, Page 651; provided as evidence of properties) in view of Marks (Europhys. Lett., Vol. 32).

Although Bao contemplates the properties of sexithiophene among the devices of claim 1 (Col. 8, Lines 37-40), there is no explicit teaching of actually using this material in the device.

However, Marks teaches using polycrystalline small molecule materials having a grain size, such as sexithiophene, as a single material electroluminescent layer (see Page 524, Line 1, at least). It would have been obvious to one of ordinary skill in the art at the time the invention

was made to use polycrystalline small molecule materials, such as sexithiophene, as taught by Marks for the single material electroluminescent and polycrystalline layer of Bao. One would have been motivated to do so since Marks teaches that the polycrystalline material with a grain size allow for the emission of polarized light (see Abstract, Lines 3-5). Additionally, these materials having polarized light emission are taught by marks to have the advantage of allowing optimization of devices properties, including charge mobility, polarization, and the angular distribution of light emission (Page 527, Lines 34-35). Such applications are particularly well suited for laser applications, such as that of Bao. Furthermore, it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07.

6. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao (`207) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) in view of Karl (Synth. Met., Vol. 133-134, Page 651; provided as evidence of properties) in view of Brazis, Jr. (`120).

Bao teaches the device of claim 1, but Bao does not teach the specific configuration for the electron and hole electrodes being digitated structures with regular repetition of a basic finger structure with the electron and hole electrodes alternating each other with two characteristic in-plane distances P and R therebetween being equal.

However, Brazis, Jr. teaches an organic semiconductor transistor with an electron electrode (see Element 14 in Fig. 3) and a hole electrode (see Element 15 in Fig. 3) being digitated structures with regular repetition of a basic finger structure with the electron and hole electrodes alternating each other with two characteristic in-plane distances P and R therebetween being equal (see Fig. 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the configuration set forth by Brazis, Jr. for the electron and hole electrodes of Bao. One would have been motivated to do so since Brazis, Jr. teaches that such a configuration is advantageous because such a configuration allows for wide channel widths over a small area to improve the current handling capabilities of the device (Para. 0010, 0014).

7. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao (`207) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) in view of Karl (Synth. Met., Vol. 133-134, Page 651; provided as evidence of properties) in view of Kozlov (`828).

While Bao teaches a laser devices (see Figs. 23-24 along with associated text), Bao does not teach the confinement optical resonators/cavities and waveguiding layers associated with the generation of lasing in organic light emitting structures.

However, Kozlov teaches an organic light emitting laser (see Figures) using confinement optical resonators/cavities (Elements 111, 112, "t") and waveguiding layers (Elements 161 and 162)on the first and second side of the organic light emitting layers (Element 110). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the confinement optical resonators/cavities and waveguiding layers on the first and second side of

the lasing channel of Bao as taught by Kozlov. One would have been motivated to do so since Kozlov teaches that these layers minimize waveguiding losses (see Col. 6, Lines 40-55) and form an optical cavity for resonation yielding (see Col. 3, Lines 37-42) a device with clear threshold in the output power, a well-defined laser beam, cavity modes and narrow emission spectrum (see Col. 3, Lines 17-19).

8. Claims 1-2, 4-6, 8, 21-22 and 24-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Christensen (`718) in view of Necliudov (J. Appl. Phys., Vol. 88; supplied with Office action dated 11 April 2011) in view of Marks (Europhys. Lett., Vol. 32) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties).

j. Regarding claim 1, Christensen teaches an electroluminescence generating device comprising a channel (Element 15), a source/drain electron electrode (Element 13), said electron electrode being in contact with said channel said electron electrode being able to inject electrons in said channel layer, a source/drain hole electrode (Element 14), said hole electrode being spaced apart from said electron electrode, said hole electrode being in contact with said channel and said hole electrode being able to inject holes into said channel, and a control electrode (Element 18) positioned on said first side of the channel. Regarding the language of "whereby light emission of said electroluminescent generating device can be acquired by applying an electrical potential between said electron electrode and said hole electrode" the functional descriptions and manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a

"recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). See MPEP § 2114. The recitation of " whereby light emission of said electroluminescent generating device can be acquired by applying an electrical potential between said electron electrode and said hole electrode" is an intended use functional language which does not differentiate the claimed device from the prior art device, which teaches the structure of the claim as described above. Additionally, Christensen teaches the functionality of the generating light emission by applying an electrical potential between the electron electrode and the hole electrode (see Element 20 and Col. 4, Lines 40-60).

While Christensen teaches that the electron electrode and the hole electrode form an ohmic contact with the channel layer with these electrodes beside the channel, there is no teaching that the electron electrode and the hole electrode are positioned on top of the first side of said channel layer.

However, Necliudov teaches that forming the source/drain contacts on organic semiconductors are advantageously formed on top of the channel (see Fig. 1B and associated text). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the ohmic source/drain electron and hole electrodes of Christensen on top of the first side of the channel as taught by Necliudov. One would have been motivated to do so for a variety of reasons. Specifically, Necliudov teaches that the top contact source/drains form ohmic contacts to the channel without introducing

nonlinearities (see Fig. 3 and associated text). Additionally, Necliudov teaches that the top contact source/drain configuration is the easiest to fabricate (Page 6594, Left Col., Line 19) and are superior over other designs (Page 6594, Left Col., Lines 20-21).

While Christensen teaches that the channel is a single thin layer of a single organic semiconductor material capable of carrying electrons and holes to facilitate light emission, there is no teaching of using a polycrystalline small molecule material, whereby said polycrystalline small molecule material has a crystal grain size.

However, Marks teaches using polycrystalline small molecule materials having a grain size, such as sexithiophene, as a single material electroluminescent layer (see Page 524, Line 1, at least). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use polycrystalline small molecule materials, such as sexithiophene, as taught by Marks for the single material electroluminescent layer of Christensen. One would have been motivated to do so since Marks teaches that the polycrystalline material with a grain size allow for the emission of polarized light (see Abstract, Lines 3-5). Additionally, these materials having polarized light emission are taught by marks to have the advantage of allowing optimization of devices properties, including charge mobility, polarization, and the angular distribution of light emission (Page 527, Lines 34-35). Furthermore, it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07. Since the sexithiophene of Marks emits light, it is able to carry electrons and

holes, as the light emission is due to electron / hole recombination. This evidenced by Shen who teaches that light emission requires the combination of electrons and holes and that the emitting organic semiconductor carries both electrons and holes (Fig. 1 and associated text). Additionally, the Applicant's specification (Page 11, Line 27) evidences the material property of sexithiophene as a suitable ambipolar material.

k. Regarding claim 2, Christensen teaches that a dielectric layer (Element 17) is between the channel and the control electrode.

l. Regarding claim 3, Christensen teaches that the electron electrode and hole electrode comprise at least one material which is not comprised in another of the electron and hole electrode (see Col. 4, Lines 31-33).

m. Regarding claim 5, Christensen teaches that the electron electrode comprises an element of Al (see Col. 4, Lines 31-32).

n. Regarding claim 6, Christensen teaches that the hole electrode comprises an element of Cr (see Col. 4, Lines 32-33).

o. Regarding claim 8, as already shown above, the device of Christensen in view of Marks teaches that the channel comprises sexithiophene.

p. Regarding claim 21, Christensen teaches a flexible or rigid substrate (Element 11; see Col. 4, Lines 27-28 and 61-63).

q. Regarding claims 22 and 24-27, the entirety of the language of these claims are directed towards the process of making the electroluminescence generating device of claim 1. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference. As such, the language claims 22 and 24-27 only requires the electroluminescence generating device of claim 1, which does not distinguish the invention from the prior art, which teaches the structure as claimed.

r. Regarding claim 28, Christensen teaches a method for generating electroluminescence using the device of claim 1 by recombination of electrons and hole

injected into the channel from the electron electrode and the hole electrode (see Element 20 and Col. 4, Lines 40-60, for example).

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Christensen (`718) in view of Necliudov (J. Appl. Phys., Vol. 88; supplied with Office action dated 11 April 2011) in view of Marks (Europhys. Lett., Vol. 32; supplied with Office action dated 11 April 2011) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) as applied to claim 1 above, and further in view of Rogers (Appl. Phys. Lett., Vol. 75; supplied with Office action dated 13 July 2009).

Christensen in view of Necliudov in view of Marks teaches the device of claim 1, but Christensen is silent regarding conventional details such as the separation distance between the electron and hole electrodes.

However, Rogers teaches forming an organic transistor with a separation distance between the electron and hole electrodes (source/drains) of, for example 100 nm or 0.1 microns (see Abstract; Page 1010, Left Col., Lines 28-33). It would have been obvious to one of ordinary skill in the art at the time the invention was made to set the distance between the electron and hole electrodes (source and drain) of Christensen to be small, such as the 100 nm or 0.1 microns of Rogers. One would have been motivated to do so since Rogers teaches that such small distances result in a device with low voltage and high current characteristics (see Abstract; Page 1010, Left Col., Lines 28-33; Page 1012, Right Col., Lines 25-29) making them even suitable for light emission circuitry.

10. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Christensen (`718) in view of Necliudov (J. Appl. Phys., Vol. 88; supplied with Office action dated 11 April 2011) in view of Marks (Europhys. Lett., Vol. 32; supplied with Office action dated 11 April 2011) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) as applied to claim 1 above, and further in view of Brazis, Jr. (`120).

Christensen in view of Necliudov in view of Marks teaches the device of claim 1, but Christensen does not teach the specific configuration for the electron and hole electrodes being digitated structures with regular repetition of a basic finger structure with the electron and hole electrodes alternating each other with two characteristic in-plane distances P and R therebetween being equal.

However, Brazis, Jr. teaches an organic semiconductor transistor with an electron electrode (see Element 14 in Fig. 3) and a hole electrode (see Element 15 in Fig. 3) being digitated structures with regular repetition of a basic finger structure with the electron and hole electrodes alternating each other with two characteristic in-plane distances P and R therebetween being equal (see Fig. 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the configuration set forth by Brazis, Jr. for the electron and hole electrodes of Christensen. One would have been motivated to do so since Brazis, Jr. teaches that such a configuration is advantageous because such a configuration allows for wide channel widths over a small area to improve the current handling capabilities of the device (see Para. 0010 and 0014).

11. Claims 3 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Christensen (`718) in view of Necliudov (J. Appl. Phys., Vol. 88; supplied with Office action dated 11 April 2011) in view of Marks (Europhys. Lett., Vol. 32; supplied with Office action dated 11 April 2011) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) as applied to claim 1 above, and further in view of Bao (`207).

s. Regarding claim 3, Christensen teaches a dielectric layer (Element 17) between the control electrode and channel, but is silent regarding the material.

However, Bao teaches using silicon oxide (SOG) or polyimide, as the gate dielectric material in light emitting field effect transistors (see Col. 5, Lines 9-14). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use silicon oxide or polyimide as taught by Bao for the gate dielectric of Christensen. One would have been motivated to do so since Bao teaches that these materials are suitable as gate dielectrics in organic field effect transistors applications and can be formed conveniently by spin-on techniques (see Col. 5, Lines 12-14, for example). It has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07.

t. Regarding claims 15 and 16, Christensen teaches that the control electrode is formed on the first side of the channel instead of the second side (see Fig. 1).

However, Bao teaches that the control electrode is an injection/current control electrode being positioned on the second side of the channel (see Fig. 23 with Element 94 on bottom and also bottom gate structures shown in Fig. 19, for example). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the control electrode of Christensen on the second side of the channel as taught by Bao. One would have been motivated to do since Bao teaches that the bottom gate configuration (second side of the channel) is advantageous due to simple processing, avoidance of hole processing conditions of etchants, cleaning agents and high temperature and provides inherent electrical isolation between adjacent devices in an integrated circuit (see Col. 3, Lines 2-8).

Regarding the language of "injection control electrode" and "whereby the application of an electrical potential difference between said control electrode and said hole electrode or electron electrode facilitates the injection of charge carriers into the channel" (claim 15) and "current control electrode" and "whereby the application of an electrical potential difference between said control electrode and said electron and/or hole electrode allows to control the current of at least one type of charge carriers" (claim 16) the functional descriptions and manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). See MPEP § 2114. The recitation of "injection control electrode" and

"whereby the application of an electrical potential difference between said control electrode and said hole electrode or electron electrode facilitates the injection of charge carriers into the channel" and "current control electrode" and "whereby the application of an electrical potential difference between said control electrode and said electron and/or hole electrode allows to control the current of at least one type of charge carriers" are intended use functional language which does not differentiate the claimed device from the prior art device, which teaches the structure of the claim as described above. Additionally, Christensen and Bao teach such functionality since the control electrode is a gate electrode.

12. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Christensen (`718) in view of Necliudov (J. Appl. Phys., Vol. 88; supplied with Office action dated 11 April 2011) in view of Marks (Europhys. Lett., Vol. 32; supplied with Office action dated 11 April 2011) in view of Shen (ChemPhysChem, Vol. 6, Page 17; provided as evidence of properties) as applied to claim 1 above, and further in view of Kozlov (`828).

While Christensen in view of Necliudov and Marks teaches polarized emission, there is no teaching of confinement optical resonators/cavities and waveguiding layers on the first and second side of the channel layer.

However, Kozlov teaches an organic light emitting laser (see Figures) using confinement optical resonators/cavities (Elements 111, 112, "t") and waveguiding layers (Elements 161 and 162)on the first and second side of the organic light emitting layers (Element 110). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the

confinement optical resonators/cavities and waveguiding layers on the first and second side of the light emitting channel of Christensen in view of Necliudov in view of Marks as taught by Kozlov. One would have been motivated to do so since Kozlov teaches that these layers minimize waveguiding losses (see Col. 6, Lines 40-55) and form an optical cavity for resonation yielding (see Col. 3, Lines 37-42) a device with clear threshold in the output power, a well-defined laser beam, cavity modes and narrow emission spectrum (see Col. 3, Lines 17-19).

Response to Arguments

13. Applicant's arguments filed 8 August 2011 have been fully considered but they are not persuasive.

14. The Applicant traverses the rejection of claims 1-3, 12, 15-16, 21-22 and 24-28 under 35 U.S.C. 102(a) as being anticipated by Bao ('207). The Applicant argues that Bao fails to disclosure the limitation of "a single polycrystalline small molecule material which is able to carry electrons and holes" (see Remarks Page 8, Lines 13-14). The Applicant takes the position that "Bao discloses a combination of two organic semiconductor materials: one of them is suitable for carrying p-type charge and the other is suitable for carrying n-type charges" (see Remarks Page 8, Lines 15-17). The Applicant points to Col. 6, Lines 22-23; Col. 7, Lines 16-18; and Col. 9, Lines 64-66 for support (see Remarks Page 8) and concludes from these passages that "it is clear from the specification that that [sic] fluorene oligomers disclosed by Bao are not capable of carrying both electrons and holes" (see Remarks Page 8, Lines 26-27).

These arguments are not persuasive for the following reasons. As noted above, Bao discloses that the "oligomers of the invention…have useful emission properties" (see Col. 10, Lines 5-8) and that the transistor is formed with "the oligomer semiconductor of the invention is shown at **91**" (see Col. 10, Lines 9-11). The oligomer semiconductor of the invention emits light and Bao recognizes this "photoemission from the oligomer semiconductor layer" (see Col. 10, Lines 12-14). Bao further evidences the light emission by providing "Curve **71** is a plot of the emission spectrum for 2F, curve 72 is a plot of the emission spectrum for FTF, and curve 73 is is a plot for FTTF (see Col. 10, Lines 19-20). Contrary to the Applicant's assertions, there is simply no disclosure in Bao that any other materials or layers are included with the anticipatory structure. Specifically, as shown above Bao only sets forth that the oligomer of the invention is present in Element 91. The Applicant's position is in error since it relies upon an erroneous insertion of additional layers into the anticipatory device of Bao set forth. Bao simply does not teach that there are two layers of materials. One cannot simply change the prior art disclosure in an attempt to allege patentability. Furthermore, the Applicant's citations of Col. 6, Lines 22-23; Col. 7, Lines 16-18; and Col. 9, Lines 64-66 in Bao were not cited by the examiner in the rejection and do not provide support of the Applicant's position that Bao fails to disclose claimed limitations. The reasons are as follows. As already established, Bao discloses that the oligomers have light emission properties in the transistor structure of Fig. 23 (see Col. 10, Lines 5-22). Since light is emitted the oligomers of Bao, they must be capable of carrying both electrons and holes. Light emission occurs due to recombination of electrons and holes. This is evidenced by Shen (ChemPhysChem, Vol. 6, Page 17) who teaches that:

In OLEDs, for example, metal electrodes inject electrons and holes into opposite sides of the emissive organic layer(s). As shown in the energy level diagram of Figure 1, electron injection takes place from the Fermi level of the cathode into the manifold of the lowest unoccupied molecular orbitals (LUMO) of the organic layer. An energy barrier φ_e has to be overcome. At the

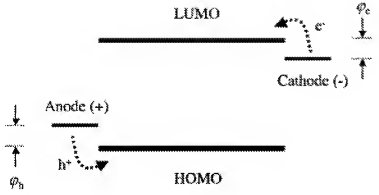

Figure 1. Energy level diagram of a single layer organic light emitting diode. Shown are the highest occupied and lowest unoccupied molecular orbitals (HOMO and LUMO, respectively) of the organic semiconductor and the Fermi levels of the anode and cathode. Energy barriers for hole and electron injection (φ_h and φ_e, respectively) are indicated.

same time, hole injection (or electron extraction) takes place from the Fermi level of the anode into the manifold of highest occupied molecular orbitals (HOMO) of the organic layer. The two carriers then recombine in the bulk of the organic layer to produce light.[1]

Therefore, since the oligomers of Bao emit light, which requires the recombination of electrons and holes, both of must be carried by the oligomers of Bao. This contradicts the Applicant's position that "While it may be that the oligomers of Bao have useful emission properties, this is simply not relevant to the issue of whether or not these oligomers are ambipolar…because emission properties are distinct from charge mobility properties" (see Remarks Page 9, Lines 1-4). Instead, as shown herein, emission properties have everything to do with the ability to carry

both electrons and holes. In fact, emission properties requires the ability to carry both electrons and holes to a degree sufficient enough for charge recombination to occur in the oligomer. As such, the oligomers of Bao meet the limitation of being "able to carry both electrons and holes". This ability of the oligomers of Bao to carry both electrons and holes is further evidenced by Karl (Synth. Met., Vol. 133-134, Page 651) who teaches, for example, that:

> Pure organic semiconductors are intrinsic, i.e. both charge carrier signs contribute to conductivity; it should be mentioned, however, that their mobilities can be fairly different.

Therefore, as noted by Karl pure organic semiconductors are ambipolar (able to carry both electrons and holes) to some degree, even if the contribution of electrons may have relatively low mobility as compared to holes. Nevertheless, the ability to carry both electrons and holes is still present, even if the relative degrees are different. Regarding the oligomers of Bao, the relative mobility of the electrons and holes must be close enough in order for the materials to emit light (at Element 96 in Fig. 23), but also for that light emission to be centered between the source and drain electrodes (see Fig. 23). The claim as currently written does not set forth the degree to which electron charges are carried relative to hole charges to distinguish the invention from the prior art. Furthermore, even though Bao refers to the oligomers as "p-channel materials" (see Applicant's citations above), the examiner notes that there is no requirement that a person of ordinary skill in the art would have recognized the inherent disclosure at the time of invention, but only that the subject matter is in fact inherent in the prior art reference. Schering Corp. v. Geneva Pharm. Inc., 339 F.3d 1373, 1377, 67 USPQ2d 1664, 1668 (Fed. Cir. 2003). See MPEP § 2112.

In conclusion, for the reasons set forth above, the Applicant's arguments on this matter are not persuasive and the rejection of claims is maintained.

15. The Applicant traverses the rejection of claims 4-6, 8, 13-14 and 19-20 as unpatentable under 35 U.S.C. 103(a). The Applicant traverses these rejections for the same reasons as already argued above. In response, the examiner notes that these arguments are also not persuasive for the same reasons set forth above.

16. The Applicant traverses the rejection of claims 1-3, 12, 15-16, 21-22 and 24-28 under 35 U.S.C. 102(a) as being unpatentable over Christensen ('718) in view of Necliuidov (J. Appl. Phys., Vol. 88) in view of Marks (Europhys. Lett., Vol. 32). The Applicant argues that Christensen does not teach that the semiconductor layer of MEH-PPV is not capable of carrying both electrons and holes. The Applicant cites to Chua (Nature, Vol. 434, pages 194-199) for support. The Applicant uses Chua in an attempt to demonstrate that "up to March 10, 2005, the MEH-PPV material was considered to be only a p-type material" citing portions of the reference (see Remarks Page 13, Lines 8-30 and Page 14, Lines 1-7). In response, the examiner notes that this reference of Chua actually contradicts the Applicant's position. The reason is because the conductivity of organic semiconductors is a material property and it is irrelevant when a particular author realizes this. There is no requirement that a person of ordinary skill in the art would have recognized the inherent disclosure at the time of invention, but only that the subject matter is in fact inherent in the prior art reference. Schering Corp. v. Geneva Pharm. Inc., 339 F.3d 1373, 1377, 67 USPQ2d 1664, 1668 (Fed. Cir. 2003). See MPEP § 2112. For example,

just as gravity existed after Newton realized it, gravity also existed before Newton. Additionally, the Chua reference cited by the Applicant provides evidence that MEH-PPV is ambipolar (see Table 1 on Page 196 showing that the material has a charge carrier mobility for both electrons and holes) and contradicts the Applicant's position that MEH-PPV is p-type.

Applicant argues that "Marks discloses the use of an α6T material in a p-type device, i.e. an OFET which is capable of transporting only p-charges" (see Remarks Page 14, Lines 21-22). This is not true. Marks says nothing about the α6T material being a p-type material. Furthermore, it is immaterial to the issue since products of identical chemical composition can not have mutually exclusive properties. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). See MPEP § 2112.01. The device of Christensen as modified by Marks uses a polycrystalline single material of α6T as the light emitting layer (Element 15 of Christensen). This is an identical material that the Applicant discloses as a material suitable for the invention as the ambipolar material (see Specification Page 11, Line 27) and claims (see claim 8, Line 4). Therefore, the Applicant's assertion that α6T is p-type amounts to an argument against the teachings of their own disclosure which could raise question whether the disclosure complies with 35 U.S.C. 112, first paragraph.

Additionally, Marks teaches that α6T is a light emitting material, and since light is emitted from the α6T material must be capable of carrying both electrons and holes. Light emission occurs due to recombination of electrons and holes. This is evidenced by Shen (ChemPhysChem, Vol. 6, Page 17) who teaches that:

In OLEDs, for example, metal electrodes inject electrons and holes into opposite sides of the emissive organic layer(s). As shown in the energy level diagram of Figure 1, electron injection takes place from the Fermi level of the cathode into the manifold of the lowest unoccupied molecular orbitals (LUMO) of the organic layer. An energy barrier φ_e has to be overcome. At the

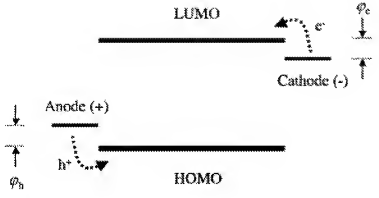

Figure 1. Energy level diagram of a single layer organic light emitting diode. Shown are the highest occupied and lowest unoccupied molecular orbitals (HOMO and LUMO, respectively) of the organic semiconductor and the Fermi levels of the anode and cathode. Energy barriers for hole and electron injection (φ_h and φ_e, respectively) are indicated.

same time, hole injection (or electron extraction) takes place from the Fermi level of the anode into the manifold of highest occupied molecular orbitals (HOMO) of the organic layer. The two carriers then recombine in the bulk of the organic layer to produce light.[1]

Therefore, since the oligomers of Marks emit light, which requires the recombination of electrons and holes, both of must be carried by the α6T of Marks. The Applicant argues that it is impermissible hindsight use the α6T of Marks as the light emitting channel of Christensen (see Remarks Page 14, Lines 25 and Page 15, Lines 1-4). This is not persuasive because Marks provides known motivation to use the material of α6T for the light emitting application since Marks teaches that the polycrystalline material with a grain size allow for the emission of

polarized light (see Abstract, Lines 3-5). Additionally, these materials having polarized light emission are taught by marks to have the advantage of allowing optimization of devices properties, including charge mobility, polarization, and the angular distribution of light emission (Page 527, Lines 34-35).

In conclusion, for the reasons set forth above, the Applicant's arguments on this matter are not persuasive and the rejection of claims is maintained.

17. The Applicant traverses the rejection of claims 3, 12-16 and 19-20 as unpatentable under 35 U.S.C. 103(a). The Applicant traverses these rejections for the same reasons as already argued above. In response, the examiner notes that these arguments are also not persuasive for the same reasons set forth above.

Contact Information

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew W. Such whose telephone number is (571)272-8895. The examiner can normally be reached on Monday - Friday 9AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kiesha Bryant can be reached on (571) 272-1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew W. Such/
Primary Examiner, Art Unit 2891